

REVIEWS.

ART. XI. *First Lines of Physiology, designed for the use of Students of Medicine.* By DANIEL OLIVER, M. D., Professor of the Theory and Practice of Physic, &c., in Dartmouth College. Boston, 1835. 8vo, pp. 520.

These First Lines can lay no claim whatever to novelty or originality; we are, nevertheless, persuaded that their publication will entitle Dr. Oliver to the thanks, not merely of the medical student, but of all who may be desirous of acquiring a knowledge of the interesting and important science of physiology. Among the numerous manuals that have of late years appeared, we know indeed of none better adapted, in all respects, to afford a general view of the leading facts and principles connected with the physiology of the human body, and to prepare the mind for the study of those more extensive treatises in which the science is taught in all its details.

The author has exhibited great industry in collating the best authorities, and no little judgment in selecting and carefully digesting and arranging his materials. He has thus been enabled to present a large mass of facts in a form which, though extremely concise, is, at the same time, sufficiently perspicuous.

The work of Dr. Oliver professes to give nothing more than a mere outline of human physiology, yet it will be found to comprise a very accurate summary of the present state of the science, together with a notice of the different views of leading physiologists in regard to the several points which are still in dispute.

It is not our intention to enter upon a regular review of the facts and doctrines set forth in the work before us, which would lead to an examination of the actual state of physiology, but merely to present to our readers a general idea of its plan, and the manner in which the author has accomplished the object which he had in view in its publication.

After defining physiology, and noticing the two leading classes of bodies, the inorganic and organic, and their respective material and dynamic properties, Dr. O. next considers the relations of organic bodies to heat, light, and electricity. Animals and vegetables are then compared, and a general view presented of the scientific division of the animal kingdom. These subjects occupy the first five chapters. With the sixth chapter commences the general view of the structure of the human body, comprising the anatomical, chemical, and physiological analysis of its organization.

This portion of the First Lines presents an admirable digest of

those particulars which may be considered, in some measure, introductory to the strictly physiological portion of the work.

When treating of the general properties of the human organization, Dr. Oliver sets down that of active expansibility as being possessed by certain of the tissues and organs. Now, although we are not ourselves inclined to deny the possibility or even probability of the existence of such a property, especially in the capillaries, we conceive that it is altogether incorrect in the author to include it among those properties of the organization which are unequivocally established. Many eminent physiologists will not admit even the possibility of its existence, and many difficulties, it must certainly be confessed, stand in the way of its admission. In regard to a majority of the phenomena attributed to the power of active expansibility by Dr. O., they can be satisfactorily explained, without the necessity of supposing them to depend upon the exercise of a property, to say the least of it, so purely hypothetical.

We extract all that the author says upon this subject.

"Expansibility."—Another of the motive forces, is *expansibility*, a property, by the exercise of which a part becomes the seat of a turgescence or active dilatation. This power differs from elasticity, which is purely a physical property, in not requiring the application of an expanding force. It is directly opposed in its nature and effects to the faculty of contractility.

The property of expansibility is exemplified in the phenomena of vital turgescence in the *erectile tissues*, as the male and female organs of generation, both external and internal, which become turgid, and gorged with blood, under the influence of venereal desire; and in the nipple, which is similarly affected in the act of suckling. The same property is manifested in the skin, and the subcutaneous cellular tissue. Thus, the face is said to swell with pleasure, the neck to become tumid with anger; the ends of the fingers experience a degree of erection in the act of touching, and the papillæ of the tongue in tasting. In a state of inaction, these papillæ are small, soft, pale, and indistinct. In a state of erection on the contrary, they are enlarged, erect, red, and turgid with blood. In fact any of the soft-solids, which are furnished with blood-vessels, may become the seat of this phenomenon. Any of them may become the focus of a fluxion of blood, if subjected to irritation. Thus, the internal membranes, as the serous, mucous, and synovial, when irritated, become turgid with blood, which accumulates in their vascular tissue. This is particularly exemplified in the gastric mucous membrane, when excited by the presence of aliment; and in the serous and synovial membranes, when exposed to the air, or subjected to any kind of irritation. The glands exhibit similar phenomena under the same circumstances; and even the muscles and nerves, and other parts provided with vessels, become turgescent with blood, when laid bare, and subjected to irritation.

The parts which exhibit this phenomenon in the most conspicuous degree, as the organs of generation and the nipples, are composed of a tissue of blood-vessels, interlaced with numerous ramifications of nerves.

The erectile tissues are sometimes developed accidentally, or by disease. Aneurism by anastomosis is of this description. Haemorrhoidal tumours, also, sometimes present all the characters of the accidental erectile tissues.

The dilatation of the heart, which succeeds the systole of the organ, and the expansion of the iris, in the contraction of the pupil of the eye, are referred by some physiologists to this species of vital motion. During the dilatation of the heart, the organ swells up, and becomes harder, in expanding to receive or suck up, as it were, the next wave of blood from the veins.

The expansion of the iris which produces the contraction of the pupil, is regarded as the active motion of the iris, because it is produced by the stimulus of light on the eye; whereas the contraction of the iris by which the pupil is enlarged, is occasioned by the absence or diminished energy of the proper stimulus

of the eye, and is always greatest in cases of paralysis or much debility of the organ.

"The structure of the iris, however, is a subject of controversy among anatomists. According to Magendie, and others, it is unquestionably muscular, and is composed of two sets of fibres, one of which is exterior and radiated, and by its action dilates the pupil; while the other, which is interior or next the pupil, is circular, forming a sphincter, which, by its contraction, diminishes this aperture. If this be admitted, the contraction of the pupil is the effect of muscular action, and cannot be referred to the expansibility of the iris."

"It has been conjectured that the act of absorption may be promoted by the exercise of this power in the absorbent vessels, their inhaling radicles thus opening to receive and suck in the fluids which they are destined to absorb. The extent and limits of this force, however, are not accurately defined."

With chapter xii. commences the consideration of the functions. The arrangement of the functions adopted by Dr. Oliver, is that of Chaussier, into *vital*, *nutritive*, *sensorial*, and *genital*. Every classification which can be adopted, must, it is evident, be more or less arbitrary and defective. We admit with Dr. O. that the preceding is, upon the whole, less objectionable than any other—it is at least equally useful for all the purposes of arrangement.

Under the head of *vital* functions, the doctor includes those of which the continued exercise is absolutely indispensable to the maintenance of life. These functions are *innervation*, *circulation*, and *respiration*.

The exercise of the second class of functions, the *nutritive*, is not so immediately necessary to life as that of the first. This class includes *digestion*, *absorption*, *nutrition*, and *secretion*.

The third class of functions, the *sensorial*, are still less necessary to life than either of the former, and their exercise may be suspended for a considerable time without danger. The sensorial functions are those of relation; namely, the *sensations*, *intellectual operations*, and *voluntary motions*.

The fourth class of functions, the *genital*, have no concern in the preservation of the individual, but relate solely to the perpetuation of the species.

The term *innervation* is made use of by our author to express the influence of the nervous system upon organic life in general. This is a subject, however, upon which we have still very little positive knowledge, very different and dissimilar opinions being entertained in relation to it by eminent physiologists.

Thirteen pages of the *First Lines* are occupied with a minute anatomical description of the nervous system. This, in our opinion, is altogether unnecessary—mere anatomical details are misplaced in a work devoted strictly to physiology, particularly in a compendium of the science composed for the use of medical students. An accurate knowledge of the anatomical structure of the human body and of its several tissues and organs is unquestionably an essential prerequisite to the investigation of the functions and phenomena of life, but this knowledge is to be obtained from the proper sources, previously to entering upon the study of physiology. The anatomical details generally admitted into physiological treatises are seldom calculated to

convey to the reader a sufficiently distinct and accurate idea of the form and structure of the several parts of the organism.

The general view presented by our author of the functions of the nervous system is clear, and on all those points which may be considered as fully settled, it deserves great credit for its accuracy. The mass of facts which have been adduced of late years, in relation to this important subject, have been carefully collected and digested, and arranged with much skill.

In considering the influence of the brain over the nutrition of the body, Dr. Oliver instances the circumstance of "the paralysis of a limb often tending to atrophy or withering." This, however, only indicates a very indirect influence. Even when no interruption of the nervous influence has taken place in a limb, if by any means it be kept in a state of complete inaction, the same or even a greater degree of atrophy will be induced.

The following is Dr. Oliver's summing up of the several functions of the brain:—

"On the whole, the brain is the organ of intelligence; it directs the means by which we react upon the external world; it exercises an important influence over the functions of internal life; and, as the great centre of the nervous system, is probably the principal organ of sympathy.

"These functions of the brain, especially the two latter, render this organ indispensable to life in the higher classes of animals; and, accordingly, we find that injuries of this organ from accident or disease, are generally, though not invariably, fatal.

"Though it be true, however, that the functions of internal life are more or less influenced by cerebral innervation, yet it must not be inferred that they are dependent on this organ; since it is well known that full grown fetuses have been born, destitute of every trace of brain, and even of a spinal marrow. From this, it would seem, that during foetal life, the innervation of the ganglionic system is sufficient to maintain the nutritive and vital functions, in their imperfect and rudimentary state; but that, after birth, when the individual commences a new and more elevated existence, when all the phenomena of animal or external life start at once into existence, and the brain, their common centre, is roused to the exertion of all its sleeping energies; when two of the most important of the organic functions which are immediately dependent on encephalic innervation, viz. digestion and respiration, first begin their exercise; the empire of the brain is extended over all the functions of life, connecting them together in a bond of reciprocal dependence and sympathy; and cerebral innervation then becomes indispensable to their regular exercise, and consequently to animal life."

In the sections devoted to the sensorial functions of the brain—the sensorial functions of the spinal cord—the influence of the spinal marrow over the organic functions, and to the functions of the nerves generally, there are many points which would admit of discussion were it our object to enter upon a regular review of the doctrines advanced in the work before us. Upon disputed points, however, the author had, unquestionably, a right to adopt such conclusions as appeared to him to be established by known facts. This right he has formally claimed in his preface.

"There are many questions," he remarks, "on which physiologists are by no means agreed, and what one holds to be sound doctrine may be regarded as heretical by another; and, of course, it is impossible for any system of opinions to obtain universal approbation. On such questions, the author has exercised the common privilege of being guided by his own judgment, after carefully weighing the authorities and the evidence on opposite sides of the disputed points."

Dr. Oliver's account of the intellectual and moral faculties of the brain, though highly interesting, and like most of the subjects of which he treats, presented with great clearness, is nevertheless meagre and unsatisfactory. This part of physiology has occupied, of late years, so closely the attention of the most distinguished cultivators of the science, and has given rise to so much controversy, that we had a right to expect even in a compendium of physiology like the present, a more extended view of the present state of opinions in relation to it. The subject of phrenology does not receive the slightest notice; this is the more remarkable, as Dr. O. considered it necessary to introduce a chapter on animal magnetism, in consequence of the attention which the latter has recently attracted, believing that "a doctrine embraced by such men as Rostan, Georget, Guersent, Itard, Hufeland, and many other distinguished names, ought not to be rejected with contempt, and without examination, as a tissue of the grossest charlatanism and fraud."

Whatever may be thought of the force of the evidence which has been adduced in support of the general doctrines of phrenology, this much at least must be admitted, that the latter are of too interesting a character to permit of their being passed over in perfect silence. We do not know how any system of physiology can be considered complete that does not present a very full exposition of them.

The circulation of the blood constitutes the subject of chapter xiv. The author here exhibits a very able digest of every important fact and doctrine connected with this important function.

Dr. O., as we have already seen, assumes for the heart the power of active dilatation; he has not, however, adduced in the present chapter any striking arguments to establish his position, the correctness of which will be strenuously controverted by the majority of physiologists. Another opinion set forth in this chapter, will be esteemed equally erroneous by many—we allude to the independent circulation of the capillary vessels, and their power of attracting the blood into the parenchyma of the organs for the purposes of nutrition, &c.; an opinion, nevertheless, in support of which many almost conclusive arguments may be adduced, and the adoption of which seems to be indispensable, in order to explain all the circumstances connected with the physiological as well as pathological states of the circulation.

"It appears, on the whole," says our author, "that the blood moves in the capillaries under a three-fold impulse, viz., the action of the heart, that of the arteries, and that of the capillaries themselves. This last is probably the chief cause.

"But besides this impulse, to which the blood is subjected in the capillary vessels, and which impels it forward in the course of the circulation, and causes it to pass from the arteries into the veins, it is subject to another, which attracts it into the parenchyma of the organs, to be employed in nutrition, secretion, &c. Between these two impulses the blood sometimes appears to hesitate, as if it were at a loss which to obey. The action of the heart moves it in the first direction; the peculiar action of the *nutritive* and *secretory* capillaries themselves draws it in the other. Any irritation applied to these vessels, increases the flow of blood towards them; a principle which is illustrated in inflammation. Hence, the attractive influence of the capillary vessels regulates the quantity of blood which traverses the other parts of the circle of circulation. They may either attract more or less blood to themselves, or refuse to receive it, and thus materially influence the course of the blood in the great vessels, change the pulse, and deter-

mine the quantity of blood which passes into the veins, and, consequently, of that which moves in the heart and arteries. The arteries and veins become larger in an organ which is the seat of a chronic irritation. From these, and many other similar facts, it appears not improbable that the principal office of the heart is to propel the blood into the great arteries, which is thence drawn out, as it were, by the attractive power of the capillary vessels determined by the wants of those parts of the system to which they belong.

"When a part of the capillary system attracts to it more blood than usual, the fluxion extends to the neighbouring vessels, and from them gradually to the larger arterial trunks. Hence the increased action of the arteries which go to an inflamed part.

"Each organ attracts from the great vessels different quantities of blood, according to its degree of vitality, and the activity of its functions. Even in the same part, the capillary circulation varies in its activity, according to the degree of excitement which happens to prevail. Every morbid condition of an organ is accompanied with a change in its capillary circulation. Further, there are some organs, whose functions are intermittent, as the uterus; and these must attract more blood into their vessels when in a state of activity, than when at rest. All these considerations go to establish the importance of the functions of the capillary vessels, and appear to justify the opinion of Broussais, who considers the great vessels as a reservoir to furnish the capillary system with blood; from which these last named vessels draw out only the quantities which they require."

The several forces which cause the blood to move through the veins in the direction of the heart are, according to Dr. Oliver, the *vis a tergo* derived from the action of the heart, the arteries, and the capillary vessels; the contractile powers of the veins themselves; the *aspiratory action* of the heart; the expansion of the lungs in inspiration, and the contraction of the muscles in contact with the veins.

The fact of the veins exerting a motive action upon the blood, can only be established by showing that these vessels possess the property of active contraction; now, although the experiments of Hastings and others would seem to render this at least probable, it cannot be considered as proved; consequently, Dr. O. is not warranted in assuming "the contractile power of the veins" as one of the causes by which the motion of the venous blood is produced. Neither can we admit as any better established, "the active dilatation of the heart, by which it is conceived the blood is sucked up in the veins, like water in a pump." The several circumstances adduced by the author in support of the aspiratory action of the heart, supposing these to have been accurately observed, cannot be considered as conclusive in the face of all the objections which present themselves.

Even admitting the suction power of the heart to exist, Dr. Arnott denies that it would promote the passage of the blood through the veins, because the latter being pliant tubes, would collapse from atmospheric pressure, instead of suffering the blood to be pumped into them, by the action of the heart. If, he remarks, the point of a syringe be inserted into a piece of intestine or eel skin, or a vein filled with water, on attempting to pump up the water by drawing the piston of the syringe, the water nearest the mouth of the syringe will be drawn in, and then the sides of the tube will collapse, acting as a valve to the mouth of the instrument, and putting a stop to the experiment. Dr. Oliver, however, considers that this experiment of Arnott is not a fair representation of the actual condition of the veins in the human body.

"For while the circulation is going on, the capillary vessels are constantly forcing blood *into* the veins, as fast as it is flowing *out* of them by other causes. The experiment, in order to be satisfactory, ought to be performed in a different manner. Into a piece of intestine, or eel-skin, filled with water, should be inserted not only one syringe to draw the water *out*, but by another, at the opposite extremity, to force it *in*, in the same proportion, so as to keep the vessel constantly full. Then the atmospheric pressure could not make the tube collapse, but would be exerted upon the column of fluid contained in it, and force it into the upper syringe."

It may, with great propriety, be replied to Dr. Oliver, that, admitting *his* experiment to be a fair representation of what actually takes place in the venous circulation, the *necessity* for the active expansion of the heart is entirely done away with. The syringe at the lower end of the eel-skin tube, which continually forces in the fluid, in proportion as it escapes from the upper portion of the tube, renders the action of the exhausting syringe above needless. In other words, the action of the capillary vessels, by which they "are constantly forcing blood *into* the veins, as fast as it flows *out* of them by other causes," would be sufficient to carry on the venous circulation, aided by the other forces which we know actually to exist, without the necessity of an aspiratory action in the heart. We do not wish to be understood, however, as positively denying to the heart such an action; on the contrary, we believe that many circumstances render it necessary for us to include, among the numerous forces by which the return of the blood through the veins is effected, the active dilatation of the central organ of circulation; but we object to the validity of many of the arguments by which the latter fact is attempted to be established.

Chapter xv. treats of Respiration, which, according to the arrangement adopted in the First Lines, constitutes the third and last of the vital functions. After an anatomical description of the organs of respiration, which we consider unnecessary in a work like the present, the mechanism of respiration is examined, then the chemical phenomena connected with the function, and finally the vital part of respiration. Under which heads the author presents, in his usual happy manner, a very full exposition of the present state of our knowledge in relation to each of those particulars. In summing up, in the ensuing section, the theory of respiration, we are presented with the opinions of the more eminent physiologists, without any attempt on the part of Dr. O. to bias the mind of the reader in favour of either. In the concluding section of this chapter, a very able view is presented of the influence of innervation upon respiration.

We come next to the Nutritive Functions. On the subject of Digestion, the author has consulted, with commendable industry, nearly all the recent facts and experiments which are calculated to throw light upon this important but mysterious function, and the general conclusions which he has drawn from a collation of them, are, in our opinion, sound and interesting. Recognising the solvent properties of the gastric juice, which indeed cannot now be doubted, Dr. O., nevertheless, discountenances the idea so generally entertained, that these properties are of a specific character. On the contrary, he very properly explains them by the evident composition of the fluids of the stomach secreted during digestion.

"The solvent powers," he remarks, "of this secretion, (the gastric juice,) in relation to alimentary substances, may be understood, in part, by a reference to its composition. Thus, the water which it contains dissolves several simple alimentary principles; as liquid albumen, gelatin, osmazome, sugar, gum, and starch. The hydrochloric and acetic acids dissolve several other principles which are not soluble in water; as concrete albumen, fibrin, coagulated caseum, gluten, and gliadine, a substance analogous to gluten. These acids dissolve, also, cellular tissue, membranes, tendons, cartilages, and bones. Their solvent power is assisted by heat; and, hence, the temperature of the stomach is an important agent in gastric digestion."

Notwithstanding the circumstance of all kinds of solid aliment being, immediately after their admission into the stomach, subjected to the solvent action of the gastric fluid, and by it reduced to a semi-fluid state, while alimentary substances immersed in the gastric fluid out of the stomach, are likewise dissolved and converted into a substance presenting many of the characters of chyme, and, notwithstanding it is very evident that this action of the gastric fluid upon the food is essential to its perfect digestion, yet Dr. O. does not agree with those physiologists who suppose that gastric digestion is nothing but a mere chemical solution of the aliment in the proper fluid of the stomach, and so far we entirely coincide with him.

"Chymification," he remarks, "is not to be regarded merely as a chemical solution of alimentary matter in the gastric fluid. No doubt a solution more or less perfect may be effected in this way by the solvent powers of this fluid over substances of an alimentary kind. This is established by the experiments of Spallanzani, and more fully by those of Beaumont. But it is not so certain that they become endued with all the properties of chyme, especially with those which assimilate them to the nature of the living animal body, by undergoing this process. Le Pelletier affirms, that in the experiments which he had made with food thoroughly masticated and blended with saliva, penetrated with the gastric fluid, and placed in favourable circumstances out of the stomach, he always found the food either reduced to a pulpy mass or simply softened, or in the incipient stage of acid or putrid fermentation, but never in a state of *perfect chyme*, as was proved by introducing the artificial chyme into the duodenum of living animals, when it was found that not a particle of real chyle was ever formed from it."

We confess that we should not place much importance on such an experiment as a means of settling the present question; yet there are sufficient reasons, in our opinion, for believing that the food undergoes other changes in the stomach than those effected in it by the mere action of the gastric fluid.

"It is indeed difficult to conceive," as our author has well remarked, "how a mere chemical solution of aliment can endue it with living properties, or *vitalize it*; for, undoubtedly, chyme is in the first stage of animalization. It cannot become invested with living powers, if placed out of the *atmosphere* of vitality. Vital affinity can operate only within the sphere of vital power. If, then, the gastric fluid is a mere chemical solvent of alimentary substances, it seems probable that the living coats of the stomach, with which all parts of the food are brought successively into contact, may impart to the latter certain properties which may assimilate it to the nature of the living organization, properties which it is impossible to conceive that it can acquire, when removed from the contact of living matter. Life is a unit, its properties cannot be separated from the source where they originate. It is as impossible to conceive of bottling up a portion of vitality with a few ounces of gastric fluid, as it would be to think of corking up a vial of sunshine, and keeping it in the dark."

"The analysis of digestion, proposed by Prout, corresponds in the main with this view. Prout attributes to the stomach three distinct powers, which are all exerted in digestion, viz., a *reducing*, a *converting*, and a *vitalizing* power. By the reducing power, he means the faculty which the stomach possesses of dis-

solving alimentary substances, or bringing them to a semi-fluid state. This operation he supposes to be altogether chemical. By the converting power of the stomach, he means the faculty of changing simple alimentary principles into one another, as starch into sugar and gum. Without such a power, Prout thinks that the uniformity in the composition of the chyle, which he supposes to be indispensable to the existence of animals, could not be preserved. This process of *conversion* he considers, also, as chemical, but as of more difficult accomplishment than the reducing. The vitalizing or *organizing* property, is that by which alimentary substances are brought into such a condition, as adapts them for an intimate union with the living body. This power, he says, cannot be chemical, but is of a vital character, and its nature is entirely unknown. The vital properties which the chyme acquires in the stomach, whatever these properties may be, it is the prerogative of the living or the nervous powers of the stomach to confer. The influence of these powers in digestion, is illustrated by numerous facts, especially by the influence of those medicinal agents which depress the nervous energy, as opium and other narcotics; the effect of passions of the mind, and the sudden accession of disease; and intercepting the nervous influence by the ligation or section of the par vagum; causes which can hardly be supposed competent to destroy the chemical or solvent powers of the gastric fluid, but which, nevertheless, are well known by physiologists to interrupt or weaken the process of gastric digestion."

The views of Prout in relation to digestion will be found, we apprehend, to be in the main correct. In the investigation of this process the attention of physiologists has been heretofore too exclusively confined to the sensible changes effected in the aliment within the cavity of the stomach, all of which have been very generally referred to the solvent action of the gastric fluid. Digestion, properly speaking, commences in the mouth; there can be little doubt that the processes of mastication and insalivation, though but very cursorily noticed in the work before us, effect important changes in the aliment preparatory to its conversion into chyme.

It must also be borne constantly in mind that besides being subjected to the solvent action of the gastric fluid, most alimentary substances undergo likewise in the stomach a very decided change in their chemical composition. How this change is produced is still a matter of dispute—no one, however, has as yet even attempted to prove that it results from the action of the gastric fluid.

The solution of the food is not, as some suppose, confined solely to the stomach; recent experiments have on the contrary shown that the fluids of the small intestines possess properties similar to those of the gastric fluid.

In the stomach, and along the entire course of the small intestines, the dissolved aliment is acted upon by numerous absorbents, which have the power of selecting from it certain of its principles, to be converted, by the agency of vital chemistry, into the component parts of the blood. This absorption, which is the most actively carried on in the upper portion of the intestinal tube, is in our opinion one of the chief agents in effecting the more important of the changes which we know to take place in the food after its introduction into the stomach. It is more than probable, also, that from the various secretions with which the food becomes mixed in the alimentary canal, certain principles are derived essential to its complete assimilation. But we must here close our remarks on this subject, which have been already extended further than we at first intended and the character of the

present notice of Dr. Oliver's work warrants. We shall only add, that although the account of the digestive process presented in the work before us is tolerably full and correct, the author has nevertheless neglected to notice a few very interesting facts in connexion with it, for which we are indebted to the investigation of recent physiologists. The sections which treat of chylosis and absorption are more complete; we notice nothing of any importance that has been omitted upon either of these subjects. We cannot, however, admit the truth of the following proposition.

"It (chyle) is absorbed by these vessels (the lacteals) from the aliment, after it has been digested in the stomach and duodenum, and is destined to the renovation of the blood."

We deny that chyle is ever found formed in the intestines. All the elements of which it is composed no doubt exist in the chyme of the duodenum, but it is the office of the lacteals to select and combine these elements; in other words, the chyle is formed by the lacteals themselves. In fact the author himself recognises the truth of this statement in a subsequent chapter, as we shall hereafter see.

Immediately connected with digestion are the biliary and pancreatic secretions, which are consequently treated of in the present chapter.

The different views of physiologists in relation to the former are clearly and accurately stated, the reader being left to adopt whichever of them he may deem the most plausible—a course by far the most judicious, when the subject is, like the present, so completely unsettled. There are indeed few of what are asserted as some facts in relation to the physiology of the biliary organs which are not strenuously disputed by authorities of considerable eminence.

That the bile is in no degree essential to perfect chylosis we consider to be established by uncontrovertible evidence; the manner, however, in which Dr. Oliver states the opposite opinion, is such as to lead us to believe that it is the one adopted by him. In chapter xvii. he remarks "that no other substance but chyme, which has been acted upon by the bile and pancreatic fluid, is capable of being converted into chyle." Numerous instances could however be cited in which chylosis took place with perfect regularity, without the possibility of a particle of bile being mixed with the chyme. Dr. O. also observes that "it is probable, and indeed certain, that a part of the bile secreted is immediately absorbed by the lymphatics, and conveyed into the thoracic duct." This proposition is very loosely expressed. It is highly probable that the chyle may receive some principle from the bile by which its assimilation is promoted, and it is certain also that the aqueous and some other parts of the bile are taken up by the lymphatics; but if it is meant by Dr. Oliver that any portion of the bile itself is absorbed by the lymphatics, or is found in combination with the chyle under ordinary circumstances, we believe that he will find it very difficult to adduce any satisfactory evidence in support of his position. With Tiedemann and Gmelin, and numerous other physiologists, we consider the bile, whatever office it may perform in digestion, chiefly in the light of "an important excretion, designed to maintain the blood in a state of composition necessary to qualify it

for nutrition in the different organs." This inference is fairly stated in the work before us, and a summary given of the reasons upon which it rests.

The section on food is interesting, and, so far at least, as regards general principles, correct. Much more might have been said with great propriety under this head, having a direct bearing upon the subject of digestion. It is curious that the author has neglected to consider both thirst, which is a physiological appetite, and drinks, a constant supply of which is more essential to the healthy condition of the organism than of food.

Absorption is treated of in chapter xvii. The various absorptions which take place regularly in the human body are divided by our author into *alimentary*, *respiratory*, *interstitial*, *recrementitious*, and *excrementitious*. The first of these occurs in the alimentary canal, and separates from the food, after its solution by the gastric juice, such principles as are capable of furnishing materials for the renovation of the blood, and through it of the several tissues of the body. The agents of this absorption are the lactaeals.

"These vessels," remarks Dr. O., "exert a peculiar vital action upon the chyme in the intestinal cavity, selecting, absorbing, and combining its nutritive principles, and converting them into a much more highly animalized fluid, termed chyle."

The following statement is at once correct and important, and accords with the views expressed by us when considering the author's account of stomachic digestion. It is somewhat strange that Dr. O. should have overlooked entirely the facts here stated when drawing up his chapter on digestion, upon which process they in our opinion throw considerable light.

"Absorption takes place throughout the whole alimentary canal. Even in the mouth the absorbents imbibe some part of the food, as is evident from the effects of wine or spirits held in the mouth. It is probable also that the absorbents of the oesophagus imbibe something from the aliment during its passage through this tube. The lymphatics of the stomach are found to be turgid during digestion. But, the chyliferous absorbents of the small intestines are particularly active during digestion in imbibing the nutritious chyle. These vessels diminish in number in the inferior portion of the small intestines; but some are found in the large intestines, and their effects are evident in the increasing density and consistency of the contents of the lower part of the alimentary canal. In horses and some other animals the absorbents of the large intestines are observed to be filled with a chylelike fluid."

After a very complete exposition of the leading facts connected with alimentary absorption as carried on by the lactaeals, the author proceeds to consider the opinion of those physiologists who maintain that the absorption of chyle and of other substances from the digestive canal, is effected also by the veins. The various facts and experiments which have an immediate bearing upon this point are concisely stated; and in such a manner as to present to the reader a very full and accurate view of the subject.

The scarcely legitimate term *respiratory absorption* is applied by Dr. O. to "the introduction of an aerial principle, essential to life, into the mass of the blood," in the process of respiration. Whether the term absorption can, in its ordinary physiological sense, be applied

to the process of aeration which the blood undergoes in the lungs, will admit of dispute: the question is at least so far unsettled, as to render the assumption of the fact improper.

The subject of interstitial, or as the author terms it when he enters upon its particular consideration, *internal absorption*, is introduced by the following remarks.

"From the analogy in structure of the lymphatics with the lacteals, which unquestionably absorb a nutritive matter from the intestines—from the lymphatics constituting a part of the same system of vessels, and from the universality of their distribution, it has been inferred that their office is to absorb and to convey to the circulation the elements detached from the organs, and certain principles separated from the secreted and excreted fluids. The direct proofs of this function of the lymphatics, however, are not perfectly conclusive; and one of the most eminent physiologists of the age considers the general doctrine as resting on insufficient grounds."

Such being the state of the question in relation to internal absorption, Dr. O. very properly presents to his readers an abstract of the more important facts in favour of this function being performed by the lymphatics, followed by a sketch of those which favour the opinion that the veins are concerned in it equally with the lymphatics; and finally, the reasons which have induced several distinguished physiologists to believe that the substances which are proved to find an entrance into the veins are not absorbed by the mouths of these vessels, but penetrate through these coats by *imbibition*. From a review of the whole subject, the author draws the following conclusions.

"It appears, on the whole, that the subject of venous absorption is involved in no little obscurity, though the facts and considerations in favour of this alleged function of the veins appears to preponderate over those of a contrary tendency. Whether, however, substances which obtain an entrance into these vessels are absorbed by open orifices, or are imbibed by their coats; or whether they find their way thither by both these avenues, is a question of secondary importance. The great fact seems to be fully established, that many foreign substances find their way into the system principally, if not exclusively, by this channel; and whether they owe that prerogative to a vital or a physical cause, is evidently of no consequence, since in either case the result, as far as we know, is the same, and the means of effecting it were undoubtedly not a matter of accident, but of choice."

Chapter xviii. treats of secretion. Dr. O. defines secretion to be "the vital action of the secretory organs upon the blood, by which they extract from it and combine together the elements of a fluid, which had no existence in the blood previous to this elaboration." In some instances, however, secretion would appear to be nothing more than the separation of some element or principle already existing in the blood, as the author has himself remarked.

"If it could be proved, however, that all the substances of which the secreted fluids consist pre-existed in the blood, it would not follow that the process of secretion is a mere mechanical separation of these from the blood. It would still be necessary to suppose some peculiar elective power in the vessels of the secretory organs, by which the peculiar secretion of each gland should be separated from the mass of the blood, and collected in the excretory vessels of the gland."

It is nevertheless a curious fact recently demonstrated, that the membranes even after death, either from the peculiarity of their organization, or some other cause with which we are totally unacquainted, have the power of giving transmission to certain fluid substances

and of rejecting others, exerting apparently the very election which Dr. O. has attributed solely to a vital action. There is evidently much yet to be learned on the subject of secretion, but we believe that the time is not far distant when a good deal of the mystery which now surrounds it will be removed.

A very excellent general description is given in this chapter of the different apparatus by which secretion is effected.

The secreted fluids the author classifies:—1st. According to their compositions; 2ndly, according to their uses; 3dly, according to their consistency; 4thly, according to the structure of the organ by which they are secreted.

In relation to their composition the secretions are divided into the serous, the albuminous, the mucous, the fat or oily, and the mixed.

In respect to their uses the secretions are either *recrementitious*, or those destined to be absorbed and returned into the mass of the blood; and the *excrementitious*, or those which are in part or wholly discharged from the body.

In regard to secretions the author notices two interesting remarks, the first made by Berzelius, and the second by Tiedemann. The former observes that the secretions destined to be employed within the body for particular purposes are alkaline; while the excretions, or those destined to be evacuated, are all acid. To the excretions are referred the urine, the fluid of perspiration, and the milk; all the others are included among the secretions.

"Tiedemann observes that between the secreted and excreted fluids there exists this difference, viz. the former contain globules, or organic molecules, of which no traces can be discovered in the latter. Thus globules have been found in the saliva, the pancreatic and the spermatic fluids, and the milk, which he ranks among the secretions; while none have been discovered in the urine, the bile, the tears, &c. The bile and tears, it will be observed, Tiedemann assigns to the excretions."

In relation to their consistency, the secreted fluids are either *aeriform* or *liquid*. To the first belong the exhalations from the skin and the organs of respiration; to the latter, all the other secretions.

"The secreted fluids, considered in reference to the structure of the organs by which they are prepared, may be divided into three classes, viz. the *perspiratory* or the *exhalations follicular*, and the *glandular*."

In considering the individual secretions the author follows the latter classification, investigating first *cutaneous exhalation* or perspiration. The section devoted to this function is somewhat imperfect, several important facts connected with cutaneous exhalation being either totally omitted, or only incidentally noticed as of secondary importance. The supposition that the skin performs a function somewhat analogous to respiration, is rendered very probable by the results of recent investigations, and deserves a more extended notice than the author has thought proper to give to it, in a marginal note of only five lines.

In the section devoted to *mucous exhalation* it is stated that "in the stomach the product of this exhalation is termed the gastric fluid, which is possessed of peculiar properties, and is the great agent of

chymification." This is not strictly correct. Whatever may be the agency of the gastric juice in chymification, it is very evident that that fluid is not, as is here declared, identical with the ordinary mucous exhalation of the stomach; the secretion of the latter is constant, whereas the former is secreted only when food is taken into the stomach, or some stimulus is directly applied to its lining membrane. In the intervals of digestion the mucous secretion of the stomach is a clear, slightly opaque,ropy fluid, destitute of acidity, and when mixed with the masticated food out of the stomach, exhibits no solvent powers. The proper gastric juice is a clear, transparent liquid, perceptibly acid to the taste, capable of coagulating albumen, resisting the putrefactive process and dissolving alimentary substances even out of the stomach. We have a right, therefore, to infer, that the mucus of the gastric cavity and the alimentary solvent are distinct secretions, furnished probably by different apparatus.

We have nothing particular to remark in relation to the account given by the author of the remaining secretions; it is, generally speaking, full and satisfactory. The following pertinent remarks which occur at the close of the section devoted to urinary secretion, open a wide field for speculation.

"It is worthy of remark, that after the old matter of nutrition is taken up by interstitial absorption and conveyed into the blood, this fluid is subjected to the influence of respiration before it is carried to the kidneys; and after being purified by respiration and converted into arterial blood, it is transmitted to the kidneys to be further purified by the separation of the principles of the urine. It is a curious circumstance that the kidneys, though depurative organs, operate upon arterial blood which has shortly before been purified in the lungs; and this blood when purified by the separation of the foreign matters which may have been introduced into it, as well as of the old elements of nutrition furnished by the detritus, becomes venous blood, which must again be subjected to the action of the lungs before it can be employed for any other purposes in the animal economy. The blood, as it issues from the lungs, is perfectly adapted to the uses of the system; for we find that it is immediately transmitted to all the organs, to furnish the elements of nutrition, and of the secretions, and the necessary vital excitement. Yet we find that one-eighth of this blood is diverted into a particular channel, by which it passes to the kidneys, where it parts with certain principles which are noxious to it, and, if retained in the blood, are inevitably fatal in a short time. It is not very apparent why this particular portion of the arterial blood only should be subjected to the action of the kidneys, while all the remaining, and vastly the larger part, though equally impregnated with these noxious principles, is transmitted without this depuration to all parts of the body. Nor is it more apparent why, after undergoing this purification in the kidneys and parting with these noxious ingredients, it is rendered more unfit than it was before to administer to the wants of the economy, in being converted into venous blood and again requiring the action of the lungs to prepare it to subserve the uses of the system."

The subject of nutrition is examined in the nineteenth chapter. The account given by the author of this function is probably as satisfactory as could be expected, considering the obscurity by which almost every thing in relation to it is enveloped.

The next chapter is devoted to animal heat, and presents a very admirable outline of all that is at present known in relation to this important function.

With the thirty-first chapter commences the consideration of the

functions of relation. The physiology of the external senses, with the anatomy of their respective apparatus, occupying the five succeeding chapters.

This portion of the outlines is drawn up with no little talent; all the leading facts connected with the several subjects are succinctly noticed, as well as such of the views of distinguished physiologists as are particularly interesting, although their accuracy may not be considered as in every instance fully established. The author has, however, exhibited commendable caution in excluding from this and the other parts of the work all hypotheses which have not at least strong probability for their support.

The next subject treated of is motion, including of course the structure and functions of the muscles.

There is no part of the science of physiology that is involved in greater obscurity than are many of the points connected with the subjects treated of in the present chapter, or in relation to which it is so difficult to arrive at correct conclusions. Whether the muscles derive their power of contraction from the nerves that enter into their composition, or from an inherent and specific property of the muscular fibre itself? in what consists the essence or immediate cause of muscular contraction? why the action of some muscles is capable of being excited by the will, while that of others is totally independent of it? are questions which are still and will, probably, ever remain unsettled. What, however, is actually known in relation to muscular action, will be found to be clearly stated in the work before us, together with a brief notice of the more prominent hypotheses that have been framed in explanation of this function. The subject might, it is true, have been very readily extended to a much greater length, but we doubt whether such an extension would have the effect of shedding upon it any additional light.

There is one remark of the author which, we apprehend, may convey to his readers an erroneous idea.

"It is remarked above," he says, when speaking of the conditions necessary for the phenomena of muscular action to take place, "that the presence of vitality is a necessary condition of muscular contraction. It is to be observed, however, that certain of the muscles, both voluntary and involuntary, in some instances, *continue to act some time after death*. This is true, particularly of the heart and intestinal canal; but nearly all of them may be excited to contraction by artificial means. In the amphibia especially, as the frog and the salamander, the muscular irritability continues a long time after death. In birds, on the contrary, the irritability of the muscles is very soon extinguished, ceasing much earlier than in the mammalia and the human species.

"According to Nysten, the duration of the contractility of the muscles after death, in the different classes and orders of animals, is in the inverse ratio to the degree of energy with which the muscles are endowed during life. To this principle, however, there are many exceptions."

We are aware that the physiological fact here referred to is expressed in a similar manner by many eminent writers; and although it will be readily understood by such as are conversant with the subject, it is not the less incorrect. A muscle, it is true, will, as we have ourselves repeatedly observed, continue to act for some time

after the *apparent death* of the animal, especially if it be artificially excited. But it is not true that this action will occur after the *death of the muscle*; in other words, after it is deprived of its proper vitality. The muscle must still possess a certain amount of excitability and irritability, the presence of which is impossible in the absence of organic life, or no contraction could take place in it spontaneously, nor be produced in it by artificial stimuli. We admit the possibility of certain functions generally considered to be immediately dependant upon life, absorption and excretion especially, taking place after the actual death of the organ by which they are executed; for there is reason to believe that they depend less upon actual vitality than upon peculiarity of organization, but we deny that proper muscular contractions can possibly occur after the death of the muscles.

On the formation of the voice, (chapter xviii.) Dr. O. has principally followed the account given by Magendie. The subject deserves a more close investigation; there are many important points connected with it upon which our information is extremely limited.

This chapter finishes the consideration of the first three classes of the functions, according to the arrangement adopted in the work before us; the fourth class, or the genital, is comprised in the succeeding chapter. The organs of generation in the two sexes are described with great accuracy. As we have already remarked, we consider these anatomical details altogether uncalled for in a work professing to be a mere compendium or first lines of physiology.

In regard to the much disputed questions, whether the male semen is merely deposited in the vagina of the female, or is injected into the uterus, Dr. O. is inclined to favour the latter opinion. "It appears to be ascertained," he remarks, "that the seminal fluid does in fact reach the uterus. Some physiologists, it is true, could never discover it in this organ after copulation; but others have been more successful." He gives the names of Haller, Ruysh, Dumas and Prevost. "These last mentioned physiologists admit that they have seen it even in the fallopian tubes." A very striking case is related by Dr. Bond of Philadelphia, in the number of the American Journal of the Medical Sciences for February, 1834, in which an examination was made of the uterus of a female who committed suicide almost immediately after coitus; the interior of the uterus was found to be thickly coated with a substance having the appearance and the strong peculiar odour of semen, and the fallopian tubes contained apparently the same matter. Dr. O. is of opinion further, that the conveyance of a portion of the male semen along the fallopian tubes to the ovaries is essential to impregnation. In the correctness of this opinion we concur.

"The extreme narrowness of the fallopian tubes at their uterine extremity, affords no solid objection to this opinion; for we know that, at a later period, these canals admit of the passage of the impregnated ovum into the uterus; and besides, it must be considered that an exceedingly minute portion of the seminal fluid is sufficient for impregnation. It is also known that in plants the pollen of the stamens must traverse the vessels of the style, in order to produce fructification, and these canals are undoubtedly much narrower than the fallopian tubes in animals."

Under the head of theories of generation a very interesting sketch is presented of the most prominent hypotheses which have been presented to the world by ancient and modern physiologists, in explanation of the intimate and essential nature of this important process; as well as of the arguments adduced in support of each, and the objections to which they are severally liable.

The history of conception, of utero-gestation, and of fetal life, though belonging strictly to the subject of physiology, are omitted in the work before us. The reason given by the author for this omission, because, namely, they are usually considered in treatises on obstetrics, does not strike us as altogether satisfactory. He might with the same propriety have omitted the physiology of the eye and the ear, because these subjects are always fully treated of in works on optics and acoustics.

The subjects treated of in the three remaining chapters are sleep, animal magnetism, and death. On the first of these we have nothing particular to remark; the section on dreaming and somnambulism, introduced under this head, especially the former, are extremely meagre and unsatisfactory. The chapter on animal magnetism appears to us to be altogether out of place in a book of *first lines*, like the present, which should be confined to an account of what is actually known, or at least extremely probable. Notwithstanding animal magnetism may have "attracted, of late years, a considerable degree of interest, in some parts of Europe," and notwithstanding "several distinguished men have enrolled their names among its disciples," yet the facts upon which its very existence is based remain still to be authenticated, while some of the phenomena which are described as its effects, can be satisfactorily explained without the necessity of supposing a magnetic influence to be exerted upon the individual in whom they occur. Many of the statements in relation to the wonderful effects of animal magnetism are, as Dr. O. himself admits, in the highest degree absurd and improbable. Thus—

"After a few trials, we are told, it is not necessary for the magnetizer to apply the hands at all to the other party. It is sufficient to order him to go to sleep, and he will immediately obey, without the power of resisting the commands of the magnetizer.

"In some instances he (the magnetizer) merely exerted a strong effort of the will, without even speaking to the subject of the operation, when the latter began to yawn and stretch, and manifest some of the other signs which precede sleep," and this, too, "even at a distance of several feet, and where the two parties were separated by a door or partition, and the patient had no suspicion of what was going on." We are told that "any of the limbs or muscles of the patient may be rendered completely paralytic by the will of the magnetizer"—"and before he can recover the power of moving it, it must be *deparalyzed* by the magnetizer"—and, recollect, that all this miraculous influence is exercised by a volition of the mind "and two or three gestures."

We are also told "that the magnetized sleeper does not appear to hear the loudest noises nor to see the brightest light. Even the report of a pistol, fired close to his ear, occasions no starting nor any other motion, nor does it prevent his carrying on a conversation already commenced in an unaltered tone of voice." But the most re-

markable circumstance is "that if the magnetizer touch the body of the sleeper with his hand, the latter immediately acquires the power of hearing and understanding the magnetizer, though he remains incapable of hearing any other person."

"It is also extremely remarkable, that the will of the *magnetized* seems to be entirely under the control of the magnetizer. It appears, indeed, to be nothing but an instrument in his hands, which he directs and uses at pleasure. The person magnetized acts only through him; his desires, his thoughts are influenced by him; even his muscles, and limbs, and senses become paralyzed at the command of the magnetizer. The latter can extract from him his most secret thoughts, and compel him to disclose facts or circumstances within his knowledge, affecting his own character or interest, or those of others, and which he may have the strongest motives to keep inviolably secret."

That under certain pathological conditions of the nervous system, it is not impossible for many phenomena, bearing a similarity to those described as the effects of magnetism, to occur, must be admitted; something approaching to them we know does actually take place during a state of somnambulism; but that these phenomena can be produced on one individual by the mere touch or volition of another—continue so long as he pleases, and immediately disappear when he wills them to cease, we have not, we confess, sufficient credulity to believe; and yet this it is which constitutes the very substance of animal magnetism.

We have devoted more space to a notice of the "First Lines of Physiology" than a work of this kind may, perhaps, be considered to merit. We were, however, so much pleased with the manner in which, taken as a whole, it is executed—the general accuracy of its contents, and the very masterly manner in which the author has digested and arranged the physiological facts and deductions which it contains, that we felt desirous it should be extensively known. As a text book or an introduction to the study of physiology, we know of none we can more highly recommend. We have noticed a few omissions which it will be proper to supply whenever a second edition shall be called for.

D. F. C.

ART. XII. *Essai sur la Colique de plomb; thèse présentée et son-*

***tenue à la Faculté de Medicine de Paris, le 10 Juillet, 1835.* Par**

AUGUSTIN GRISOLLE, de Fréjus, Département du Var; Docteur en Medicine; Interne de l'Hotel Dieu; Membre de la Société Médicale d'Observation; Titulaire de la Société Anatomique; Elève lauréat de l'école pratique; Bachelier ès-sciences.

Essay on Lead Colic. By A. GRISOLLE, M. D., &c.

The above work, consisting of only about 80 quarto pages, is replete with valuable information. Most of the important and interesting questions connected with the history of the disease in question, are elucidated by a direct appeal to nature. The author presents us with a complete and exact analysis of the recorded histories of 58 patients affected with disease arising from the influence of lead. These